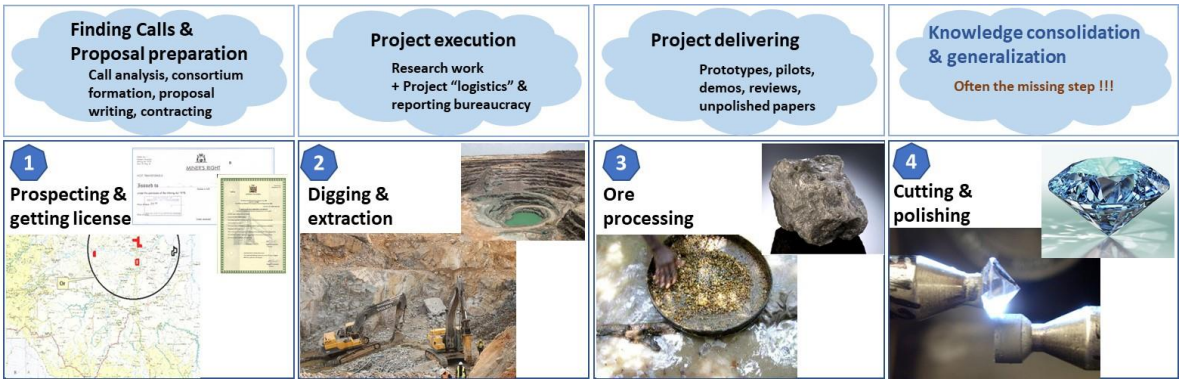
Center of Technology and Systems

NEWSLETTER

October 2020

Editorial: A call for reflection!

Sound research aiming to generate long-lasting scientific results requires dedication of time to digest, analyze, elicit, consolidate, generalize, and formulate new knowledge. And yet, these days, time is a very scarce resource for senior researchers. Most of us accumulate research activities with academic teaching duties and more and more get overloaded with administrative / management tasks. COVID-19 pandemic greatly increased the burden of bureaucracy and the pressure for "rapid responses" to a continuous avalanche of requests. We become "reactive machines", constantly switching tasks which impose huge overheads, leaving no time to think. From the research side, senior researchers exhaust their energies finding new calls and preparing project proposals. Younger researchers work hard on project execution and preparation of project-specific deliverables, while they must devote considerable time to the project "logistics" and reporting. Making an analogy with the diamond mining metaphor, most efforts go to stages 1, 2, and 3. Very rarely any effort is devoted to stage 4!



CTS has been extremely successful in attracting new funded projects and its researchers invest considerable energy in project execution and delivering. Our participation in most of those projects is often considered outstanding. And yet, among the 100 projects executed in the last 5 years, how many long-lasting scientific achievements can be identified?

Unfortunately, most efforts end at stage 3 of the mining metaphor. In terms of societal impact, CTS has been extremely successful, with remarkable achievements in different fora and even with high political visibility. But when it comes to truly scientific achievements, although various projects have "mined some brute diamonds", we often fail to polish them. Being successful with a European project is not synonymous of having generated sound and long-lasting scientific knowledge. Reviewers of these projects are often composed of consultants and other business-oriented experts, strongly biased towards immediate societal / industrial impact. Being praised by them and by funding agencies officers, or even by high level political entities, only evidence success in some (important) dimensions of impact creation; but it is not an indicator of scientific excellence. We should not forget that we are not a "systems integrator company"; we are a research center.

In addition to "acquiring and doing projects", we need to more carefully identify potential "brute diamonds". And there are a good number of them in several areas. Then we need to analyze them critically, reflect on the achievements, assess, generalize, and formalize new (emerging) knowledge. We need to produce "polished diamonds". Those are the ones that have value in the "scientific world"; "brute diamonds" look like a piece of rock. I am afraid we are losing many "diamonds" just because we don't invest on "polishing them". Critical reflection is a crucial cognitive practice in scientific research. We need to devote time and resources to it. It is urgent to go beyond stages 1 to 3 in "diamond mining". We should reserve some resources and dedicate quality time of senior researchers to invest in stage 4. Such "cutting and polishing" activity requires experts with wide experience, thus a job for senior researchers. Launching a kind of **"research consolidation" actions** as internal "projects" is crucial and urgent for the mission of a research center. Only those actions can produce a long-lasting scientific legacy.

Luis Camarinha-Matos (CTS Director)

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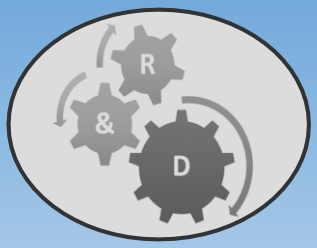


Hi-SCALE: High-Temperature SuperConductivity for AcceLerating the Energy Transition

(João Murta-Pina)

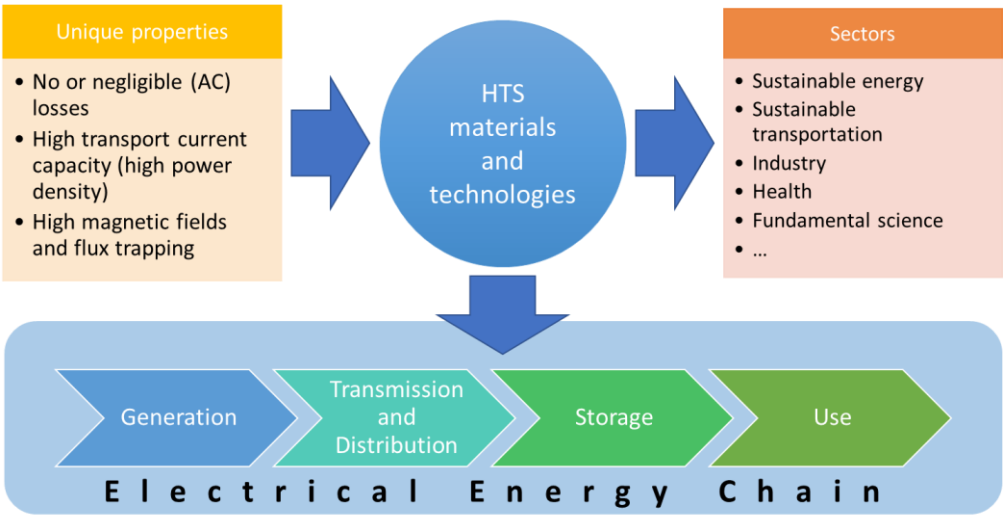
Superconductivity is a fascinating state of matter characterised by the absence of electrical resistivity that certain materials exhibit when cooled below a certain critical, cryogenic temperature. Together with other unique properties, like the ability to carry huge currents and trap extremely large magnetic fields, superconductors pave the way for accelerating the Energy Transition, i.e, the decarbonisation of the global energy sector by the second half of the 21st century.

In 1911 the Dutch physicist Heike Kammerlingh Onnes discovered that the resistivity of mercury samples vanished at the temperature of liquid helium (just around four degrees above absolute zero). Yet, only with the discovery of high-temperature superconducting (HTS) materials (in 1986), that can enter superconductivity above the temperature of cheap and abundant liquid nitrogen (77 K or -196 °C), was really triggered the interest in the application of these technologies in the electrical energy chain. Up to then, commercial large-scale applications of superconductivity were restricted to magnetic resonance imaging (MRI), based on liquid helium-cooled low-temperature superconductors (LTS), nevertheless a technology with a dramatic societal impact, only made possible by these materials.

HTS materials make possible more compact, efficient, and even disruptive technologies that can be integrated into all the links of the whole electrical energy chain, from **generation** to **transmission and distribution**, **use** and **energy storage**. They enable a myriad of concepts and devices that can boost the decarbonisation of the electrical system – as mentioned, the Energy Transition. This directly impacts several societal sectors, besides energy industries.

The development of highly efficient devices able to deliver large amounts of power in short times embody huge savings in the energy cost and/or due to poor power quality. All-electric ships and planes become possible with more compact and novel electric motors. High-field magnets and magnetic separation open new doors in the healthcare sector or in fundamental research. HTS permanent magnets (PM) become a high-performance alternative to rare hearth PM, whose shortage or geopolitics threats can affect the development of several energy and industry sectors. Overall, HTS technologies address societal challenges unprecedentedly, leading to an energy revolution that is the main driver of the recently started **Hi-SCALE COST Action**.

HTS technologies may provide unprecedented support to the Energy Transition. Yet, its dissemination is dependent on major challenges related to the need of **i)** new research and techno logical developments; **ii)** complying with legal and regulatory frameworks; **iii)** raising the industry and society awareness; and **iv)** demonstrating the sustainability of HTS technologies.



Hi-SCALE tackles all the above challenges. This ambitious goal will be achieved by a systemic approach, comprising the definition of strongly interrelated Working Groups (WG) that will thus create the path **from materials to devices** (WG1); foster **improved modelling and advanced computation** (WG2) paradigms needed for the conception, analysis and optimisation of devices; provide methodologies and demonstrators for addressing **industrial challenges and applications** (WG3); and develop tools for the **economic and sustainability assessment** (WG4) of HTS technologies.

Hi-SCALE distinguishes from other actions and projects in applied superconductivity as it covers all aspects relevant to the life cycle of this disruptive and incredibly challenging technology. Among it, and in the frame of **CTS main objectives**, highlights the envisaged contribution of Working Group 2, as mentioned, related to improved modelling and advanced computation. Among others, a high-end computational framework, able to deal with advanced numerical approximations and multi-scales in space and time for modelling HTS materials and applications will be developed. In parallel, radically new approaches in the field are foreseen, as building a collaborative platform for implementing data-driven HTS modelling paradigms. The kick-off meeting of Hi-SCALE occurred on 8 and 9 October 2020, where Uninova members were elected for key leadership positions of the Action, namely **João Murta Pina** (Chair) and **Anabela Pronto** (Short-Term Scientific Missions Coordinator).

GEO-LOC: Indoor and outdoor geo-localization and navigation by visible light communication

(Paula Louro)

The project GEO-LOC was approved by the scientific committee of the IDI&CA program (Investigação Científica, Desenvolvimento, Inovação e Criação Artística), sponsored by Instituto Politécnico de Lisboa, 5th edition. The project has an execution time of one year and the approved budget is 5k€. The research team involves members of the M2P group (P. Louro, M. Vieira, M. A. Vieira, A. Fantoni, P. Vieira, J. Costa and P. Lourenço) at CTS and MSc students of Electronics and Telecommunications (M. Lima and J. Rodrigues) at ISEL.

The scope of the project deals with the development of a communication and geo-location system through visible light, to be used by mobile users inside large buildings or in communications among vehicles using existing infrastructures for data transmission (lamps, headlights and traffic light infrastructure). The luminaires are based on white polychromatic LEDs able of simultaneously illuminating and when modulated transmitting the necessary information for the geo-location of users inside buildings or inside vehicles. Bidirectional communication between users and central infrastructure is implemented. The transmission will be carried out using different channels, allowing different data flows to be sent in parallel, using amplitude modulation. At reception, an amorphous SiC:H MUX/DeMUX device is used to demultiplex and decode information, by separating different wavelengths and

recovering the transmitted signal. Multiple-Input-Multiple-Output (MIMO) techniques will be used in the optical domain, to maximize the transmission rate.

The innovative component of the project resides in the reception module which uses an amorphous silicon photodetector with active filtering and amplification properties. It consists of a semiconductor multi-layer structure based on a-SiC:H, which behaves as an integrated optical filter, exhibiting a spectral sensitivity that can be changed by electrical or optical bias. Thus, the integration of the optical demultiplexing device with the concept of optical transmission on parallel channels (widely used in RF communications) is structural. The integration of these technologies allows the development of a low cost, short distance communication system for different applications in the domains of location, local networks, communication between vehicles and vehicle traffic control. The integration of the electronic on-chip acquisition system is one of the main contributions of the project, which will give rise to the development of a prototype, as an integrated communication system.

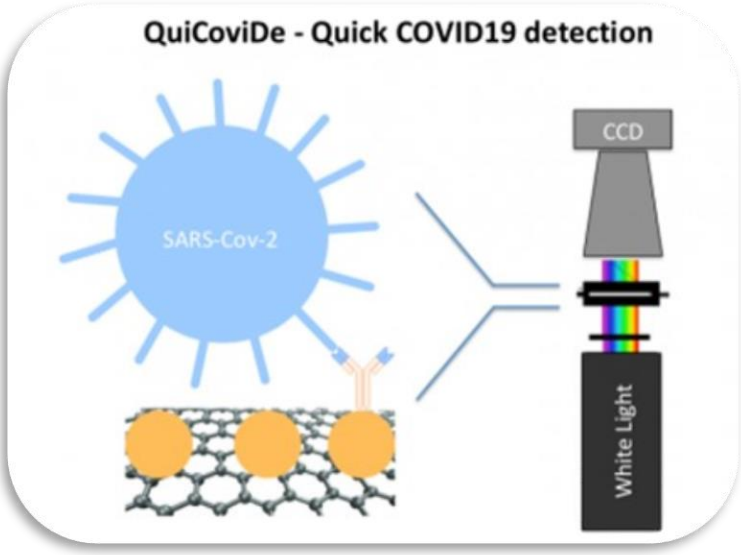
The system comprises three modules: the optical signal generator to transmit information, the photodetector for amplification, demultiplexing and receiving processes, and the electronics acquisition integrated circuit and signal processor. Each data channel is implemented as a monochromatic light source assembled with a light modulating system. that works as a selective wavelength filter with optical gain and as a decoder device, when tuned by external bias.

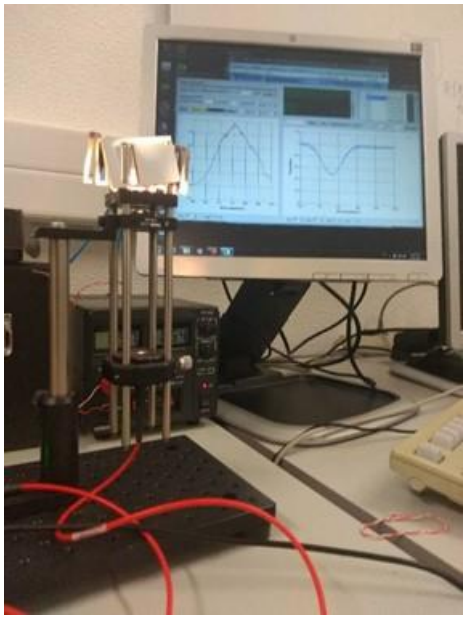
Quick COVID-19 Detection (QuiCoviDe) *(Alessandro Fantoni)*

This project (Approved in the FCT call "Projetos de implementação rápida para soluções inovadoras - COVID-19 - Fase 2") gathers a multidisciplinary team aiming at developing a quicker, cost-effective and point-of-care test to detect SARS-CoV-2 directly in samples. This portable optical immunosensor - the QuiCoviDe – targets viral surface proteins, instead of RNA or antibodies to SARS-CoV-2, solving current issues on test supply, long time-to-results, and costs. Monoclonal antibodies (Abs) targeting the Spike (S) protein of SARS-CoV-2 will be coupled to a localized surface plasmon resonance (LSPR) transducer, which detects changes in the refractive index induced by binding events with high sensitivity. The project is a collaboration between researchers from:

- CiiEM - Centro de investigação interdisicplinar Egas Moniz,
- UCIBIO/ FCT-NOVA,
- UNINOVA-CTS Center of Technology and Systems,
- CQE - Centro de Química Estrutural, Instituto Superior Técnico,
- Hospital Curry Cabral,
- Hospital Garcia da Orta.

The optoelectronic readout system is developed by the following researchers from CTS collaborating in this project: Alessandro Fantoni; Miguel Fernandes and Yury Vygranenko.





Responsible Authorship Practices

The pressure to publish, popularly represented by the slogan "Publish or Perish" sometimes lead researchers to adopt non-ethical principles regarding authorship. As such, many organizations around the world have issued guidelines on responsible authorship practices. Some examples:

IEEE (https://journals.ieeeauthorcenter.ieee.org/become-an-ieee-journal-author/publishing-ethics/ethical-requirements/**)**

IEEE considers individuals who meet **all** of the following criteria to be authors:

1. **Made a significant intellectual contribution to the theoretical development, system or experimental design, prototype development, and/or the analysis and interpretation of data associated with the work contained in the article.**
2. **Contributed to drafting the article or reviewing and/or revising it for intellectual content.**
3. **Approved the final version of the article as accepted for publication, including references.**

Contributors who do not meet all of the above criteria may be included in the Acknowledgment section of the article. Omitting an author who contributed to your article or including a person who did not fulfill all of the above requirements is considered a breach of publishing ethics.

ACM (https://www.acm.org/publications/policies/authorship**)**

Anyone listed as Author on an ACM manuscript submission must meet all the following criteria:

- they have made substantial intellectual contributions to some components of the original work described in the manuscript; and
- they have participated in drafting and/or revision of the manuscript and
- They are aware the manuscript has been submitted for publication; and
- They agree to be held accountable for any issues relating to correctness or integrity of the work.

Harvard Medical School (https://hms.harvard.edu/sites/default/files/assets/Sites/Ombuds/files/AUTHORSHIP%20GUIDELINES.pdf**)**

1. Everyone who is listed as an author should have made a substantial, direct, intellectual contribution to the work. For example (in the case of a research report) they should have contributed to the conception, design, analysis and/or interpretation of data. Honorary or guest authorship is not acceptable. Acquisition of funding and provision of technical services, patients, or materials, while they may be essential to the work, are not in themselves sufficient contributions to justify authorship.
2. Everyone who has made substantial intellectual contributions to the work should be an author. Everyone who has made other substantial contributions should be acknowledged.
3. When research is done by teams whose members are highly specialized, individual's contributions and responsibility may be limited to specific aspects of the work.
4. All authors should participate in writing the manuscript by reviewing drafts and approving the final version.
5. One author should take primary responsibility for the work as a whole even if he or she does not have an in-depth understanding of every part of the work.
6. This primary author should assure that all authors meet basic standards for authorship and should prepare a concise, written description of their contributions to the work, which has been approved by all authors. This record should remain with the sponsoring department.

Cambridge University (https://www.research-integrity.admin.cam.ac.uk/research-integrity/guidance/guidelines-authorship**)**

Normally, an author is an individual judged to have made a substantial intellectual or practical contribution to a publication and who agrees to be accountable for that contribution. This would normally include anyone who has:

1. made a significant contribution to the conception or design of the project or the acquisition, analysis, or interpretation of data for the work; **AND/OR**
2. drafted the work or reviewed/revised it critically for important intellectual content.

Anyone listed as an author on a paper should approve the final version of the paper and accept responsibility for ensuring that he or she is familiar with its contents and can identify his or her contribution to it.

Individuals who contributed to the work, but whose contributions were not of sufficient magnitude to be listed as authors should be properly acknowledged, usually in an acknowledgements section.

AJE (https://www.aje.com/en/arc/ethics-manuscript-authorship/**)**

Many journals currently adhere to the guidelines of the International Committee of Medical Journal Editors (ICMJE), which has established four criteria that each author of a paper should meet:

1. Significant involvement in study conception/design, data collection, or data analysis/interpretation;
2. Involvement in drafting or revising manuscript;
3. Approval of final version of manuscript for publication; and
4. Responsibility for accuracy and integrity of all aspects of research.

KU Leuven (https://www.law.kuleuven.be/home/onderzoek/authorship-policy-1**)**

Authorship credit should be based on the following three cumulative contributions:

a) a substantial contribution that involves an intellectual effort to either - the conception and design and/or - the acquisition/collection of data and/or - the analysis and interpretation of data;
b) substantially drafting the research output (e.g. article, paper, book) or substantially critically revising it for important intellectual content;
c) final approval of the version of the document to be published.

Only persons who fulfill all three criteria cumulatively (a + b + c) should be listed as authors. Researchers or other persons making a contribution to the manuscript in ways that do not meet the three above-mentioned criteria should not be given authorship credit but may need to be properly acknowledged in another way.

ETH Zurich (https://rechtssammlung.sp.ethz.ch/Dokumente/414en.pdf**)**

All individuals meeting all the following criteria will be considered as authors; therefore, those who:

a) contribute in an essential way to the planning, execution, control or evaluation of the research work through their personal work;
b) participate in the drafting of the manuscript; and
c) approve the final version of the manuscript.

The contributors who only partially meet the criteria should be mentioned in the "Acknowledgements" of the publication. A managing function or financial and organizational support to the project does **not** entitle anyone to appear as author. Honorary or courtesy authorship is **not acceptable**.

Imperial College London (https://www.imperial.ac.uk/research-and-innovation/about-imperial-research/research-integrity/authorship/**)**

The College's guidelines on authorship are as follows.

a) All co-authors should have made a significant intellectual or practical contribution.
b) Where there are two or more co-authors involved in a study, it is suggested that one author takes responsibility for the scientific accuracy of the entire publication. This senior author should verify that each co-author has reviewed the manuscript and is able to confirm that their area of expertise is accurate to the best of their knowledge.
c) Heads of Department are responsible for ensuring that members of the Department are not engaged in the publication of research which is not authentic, or does not add substantially to existing literature. This responsibility will in practice be delegated to principal investigators.

Vancouver criteria / ICMJE (http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html#two**)**

The ICMJE recommends that authorship be based on the following 4 criteria:

- Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; **AND**
- Drafting the work or revising it critically for important intellectual content; **AND**
- Final approval of the version to be published; **AND**
- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

In addition to being accountable for the parts of the work he or she has done, an author should be able to identify which co-authors are responsible for specific other parts of the work. In addition, authors should have confidence in the integrity of the contributions of their co-authors. All those designated as authors should meet all four criteria for authorship, and all who meet the four criteria should be identified as authors. Those who do not meet all four criteria should be acknowledged.

In the strategic agenda of CTS for the period 2018-2022, submitted to the Portuguese Foundation for Science and Technology (FCT), under the item "PROMOTION OF GOOD RESEARCH PRACTICES", it is stated:

"A particular concern with avoidance of "honorary authorship" of publications or the formation of "co-author clubs" and similar deviating practices led to the adoption of the rules of IEEE for authorship. A continuous effort to improve these practices and make all researchers aware of them will be on top of the agenda during next phase".

DoCEIS 2020 & YEF-ECE 2020

Due to the current COVID-19 pandemic we were forced to organize both DoCEIS 2021 and YEF-ECE 2021 as online events, through the ZOOM platform. The sudden change from a planned physical event to an online one was quite challenging, but the overall result was very positive.

The number of attendants in every session and every day remained quite high (higher than in past physical editions). Typically, around 85%. Paper presentations, invited keynote speeches, and panel discussions, could all be made as planned.

From what we experienced, the quality of connections does not depend on the geographical location, but rather on the local facilities in the home/institution of the participant. For instance, connections with Russia and Brazil were quite good. On the other hand, regarding connections with UK – one was very good, and another had some frozen moments.

Of course, we could not have the social interactions that typically happen during coffee breaks and lunches of a normal conference. To minimize this limitation, we asked all attendants if they were willing to share their Skype and Whatsapp id so that people could contact each other. Almost all agreed and we shared this list of contacts, but we are not sure to what extent such interactions took place.

Another aspect that we observed: participants were not very pro-active in asking questions. At least, when comparing with previous (physical) editions of the conference, there were less questions from the attendants. Perhaps they felt a bit intimated … We could compensate this because we asked (in advance) all session chairs to have prepared one or two questions per paper. As a result, all authors got questions and had the opportunity to clarify some aspects of their presentation.

Best paper awards

Three of our PhD students got a best paper award at DoCEIS 2020:

Area: Smart Systems and Manufacturing:

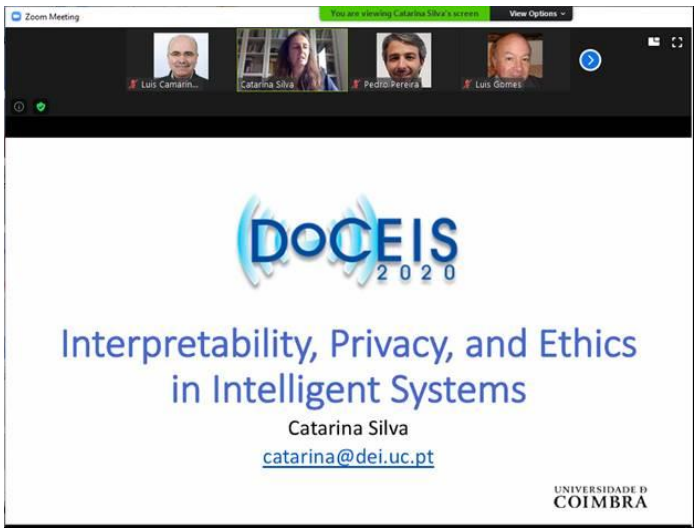
- Selecting Normalization Techniques for the Analytical Hierarchy Process
  Nazanin Vafaei, Rita A. Ribeiro and Luis M. Camarinha-Matos, in the

Area: Smart Health and Complex Algorithms:

- Combination of Medical Imaging and Demographic Data for Parkinson's Disease Diagnosis
  Helena Rico Pereira, José Manuel Fonseca and Hugo Alexandre Ferreira

Area: Energies and Networking:

- A Framework for Behavioural Change Through Incentivization in a Collaborative Virtual Power Plant Ecosystem
  Kankam O. Adu-Kankam and Luis M. Camarinha-Matos

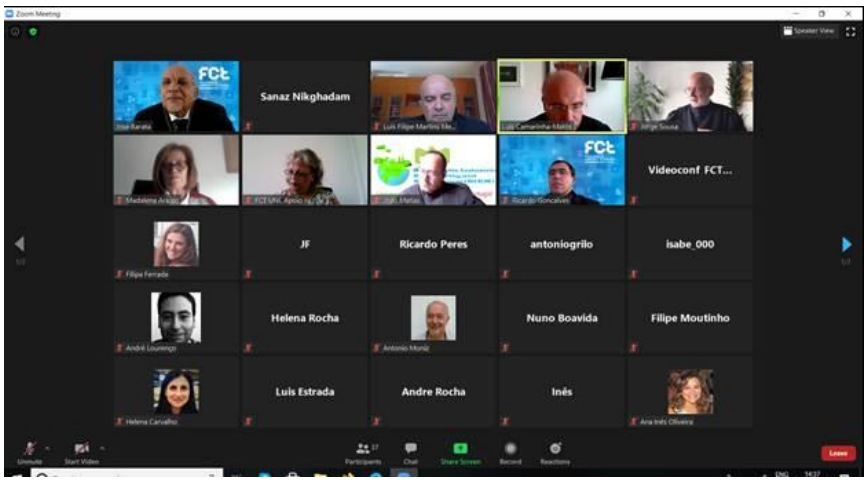


Meeting CTS – COPELABS

On 1 Oct 2020 there was a joint meeting between CTS and COPELABS (via Zoom) to discuss modalities of collaboration between the two centers. Complementarities and items of recent, ongoing, and possible future collaboration were identified. A task force was established to elaborate on further concrete plans.

Habilitation ("Agregação)

Our colleague José Barata successfully passed his habilitation exam on Electrical and Computer Engineering at the School of Science and Technology of NOVA University of Lisbon, on 28-29 Sept 2020.
Due to current COVID-19 pandemic, the exam was done through the ZOOM platform.
Congratulations José Barata !



PhD defense

Leonardo Martins, a collaborator of CTS, defended his PhD thesis at NOVA School of Science and Technology on 22 Sep 2020.
The thesis is entitled "**Image Processing and Simulation Toolboxes of Microscopy Images of Bacterial Cells**" and was supervised by Prof.s José Manuel Fonseca and André Sanches Ribeiro, both members of CTS.
Congratulations Leonardo !

DoCEIS 2021

The Advanced Doctoral Conference on Computing, Electrical and Industrial Systems is celebrating its 12th edition (DoCEIS 2021) with a focus on Technological Innovation for Applied Artificial Intelligence Systems.
Artificial Intelligence (AI) is rebuilding and changing society 's basic constructs - such as economy, health, education and life-style - through the implementation of intelligent algorithms on everyday applications and promoting technological advancements that allow for a better and more sustainable quality of life. AI techniques (e.g. machine learning and deep learning, automated planning, and reasoning) can be applied to several knowledge areas, from electronics and energy to the biomedical fi eld and industrial collaborative networks, providing several advantages that make AI a paramount tool for both industrial and research innovation.
DoCEIS 2021 will target Applied Artificial Intelligence Systems, providing a forum where Doctoral Students, Researchers and Academicians have the opportunity to share and discuss their work and ideas in a multi-disciplinary context, while creating collaborative opportunities for future work and research.

IMPORTANT DEADLINES

Submission of abstract: 15 JAN 2021
Submission of full paper: 12 FEB 2021
Notification of authors: 27 MAR 2021
Submission of camera ready: 09 APR 2021

http://doceis.dee.fct.unl.pt/

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CTS Newsletter is a publication of CTS-UNINOVA

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